South Carolina Cost of Living Index Methodology Description

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Abstract

The differences among the cost-of-living affect the quality of life in individual areas. The per capita income cannot objectively reflect the real quality of life without incorporating the cost-of-living differentiation. Currently, most of available cost-of-living indexes are only on metropolitan level, such as ACCRA. There is not an index to measure the county living costs. The major difficulty is that there are very limited county data available. This study employs a model developed by the Bureau of Economic Analysis (Aten 2006) which utilizes the CPI-covered area rent data to bridge them to other non-CPI-covered census areas. It then regresses the price level on both the CPI data and the bridged rent data and population density. This model provides us an opportunity to create a county level cost of living index. This paper discusses the application of the model to create the South Carolina county cost of living index.

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1. Introduction

This paper discusses the methodology that is used to create South Carolina county price level. Due to the differences of cost-of-living among regions, the per capita income cannot objectively reflect the real quality of life. We will first review some available cost of living measurements. Then we will talk about the application of a methodology developed by the BEA analysis to create a price index for South Carolina counties. We will also talk the pros and cons of the application and raise the proposal of developing annual S.C. county price index.

2. Literature Review

Although there are many cost-of-living measurements available, most of them can be categorized into two groups based on the fundamental of the methodology—housing based measurement and market basket measurement. The typical market basket measurement includes Consumer Price Index and ACCRA's Cost of Living Index. The Consumer Price Index constructed by the Bureau of Labor Statistics is probably the most widely used cost of living reference. The ACCRA cost-of-living index is another frequently used measurement. The common characteristic of the two indices is that both are constructed based on the cost of a basket of goods and services. The foundation of the method makes it accurately measure the real cost of living in an area. However, both indices only cover some major U.S. metropolitan areas. Policy makers and researchers need to know the difference of living costs on county or state level. In this circumstance, both CPI and ACCRA's cost-of-living index cannot provide a good reference. The Bureau of Economic and Business Research (BEBR) at the University of Florida have developed a county price index on based on the market basket method with the incorporation of over 700 occupational wages. Although the market basket measures can accurately reflect the living costs, they are very expensive to use. First, a large amount of goods and services are included, and the costs of these services and goods are collected through survey. Secondly, the cost data needs to be updated periodically, so the survey needs to be done regularly. In addition, analysis of the survey and survey data compilation are time-consuming.

In contrast with market basket measurements, the housing based measurements rely solely on housing costs. This method works under the assumption that housing and utility costs are the only driver of the cost difference among regions. Fair Market Rent (FMR) is a commonly used housing

based cost of living measurement. FMR data are estimated by the Department of Housing and Urban Development (HUD) on annual basis. FMR is the 40th percentile of the rent distribution. The rent includes the shelter rent plus the utilities paid by tenants excluding telephone, cable, satellite TV, and internet service. HUD annually estimates the FMR for 530 metropolitan areas and 2,045 non-metropolitan counties. Its obvious advantage is its large area coverage so that researchers can use it to perform analysis on various of regions. However, since it is the 40th percentile of the rent distribution, FMR may underestimate the higher income earners' quality of life. Another type of housing based measurement is a model developed based on rent data. A good example is the spatial price index model developed by Aten (2006), an economist in Bureau of Economic Analysis. This study creates a South Carolina county price level based on this model.

3. Model Description

To generate the South Carolina county cost-of-living index, we utilized the spatial price index model development by Aten (2006). The model is built based on the CPI rental data and 2000 Census rental data in two steps. The first step is to obtain the relationship between price levels and rents at the county level in all CPI areas. The results of this step are the price levels for the 425 CPI covered counties.

The second step is to bridge to the predicted price levels from the first step in the CPI areas to all US counties that are covered by Census. The bridge ratio is used to calculate the price level in non-CPI counties. Equations (1) and (2) describe the methodology employed to bridge the price level.

$$Ratio = \frac{Rent_{\text{Census}}}{Rent_{CPI}} \quad (1)$$

$$Price\ Level_{Census} = Ratio \times Price\ Level_{CPI} \quad (2)$$

Then the price level estimates (both original and bridged) are regressed on the actual individual rents and population density. The regression model is as follows:

$$lnP_i = \alpha + \beta_1 R_i + \beta_2 D_i + \varepsilon_i \quad (3)$$

where P_i is the price level for county i, R_i is the weighted geometric mean of the five bedroom categories of rent (measured in thousands) for county i, D_i is the population density measured in ten thousand population per square nautical miles in county i. β_1 and β_2 are the regression coefficient on R_i and D_i . α is the intercept of the model. ε_i is the error term of the model.

As a result of the regression, the value of the intercept is -0.38, the coefficient β_1 is 0.51 and the coefficient β_2 is 0.13. Therefore, the estimated model is:

$$\boldsymbol{lnP_i = -0.38 + 0.51R_i + 0.13D_i} \quad (4)$$

4. Data

This study uses the 2000 Census mean rent to estimate the price levels of South Carolina counties. For comparison purpose, the 2000 Fair Market Rent (FMR) and 2000 Census median rent are also used to generate the price index. The Fair Market Rent (FMR) is used by the US Department of Housing and Urban Development (HUD) to determine the eligibility of the rental housing units for the Section 8 Housing Assistance Payment Program. The data measure the 40th percentile of the rent distribution. The weighted geometric mean of the FMR data for each of the five bedroom sizes in 2000 is used to calculate the price level of each South Carolina county.

5. Results and Discussion

Table 1 provides the predicted county-level price levels from equation (4) using FMR, Census mean rent and Census median rent. We can observe that the price levels calculated from three sets of inputs are very close. Testing the mean of three groups of results (p value is 0.12), we find that there is no statistical significance among them. In addition, the state level price indices are all approximately 0.95. As verification of the model, my results match the price index calculated by Aten (2006) of 0.951.

A more robust test can be done by examining the regression relationship among the three indices. Table 2 demonstrates that the index based on Census median and the index based on Census mean are highly correlated and the former equals to 97% of the latter. According to the R-squared value, median-based index moderately correlates to FMR-based index while mean-based

index demonstrates a weak correlation. To test if the three indexes are statistically different, we performed t-test at 95% confidence level on the regression coefficient (β) with null of β equaling to 1. The result is that we cannot reject the null as shown in Table 3. This result indicates that the three indexes are statistically the same. Appendices A, B, and C provide maps of the South Carolina Price Level by County, the 2000 South Carolina Per-Capita Income by County, and the 2000 Per-Capita Income Discounted by the Price Level. These maps are based on 2000 Census median rent data.

6. Comparison with Major Southeastern Cities

To compare the price level with other areas, we also calculated the price levels in major Southeastern cities (refer to Table 4). Among the 18 southeastern cities Birmingham (AL), Knoxville (TN), Augusta-Richmond (GA), Mobile (AL) and Jackson (MS) have similar price level with South Carolina. We take the 50th percentile of the 18 cities' price level as a benchmark, which is 1.02. We can see that only Charleston and Beaufort counties have price levels above the mark. This indicates that the price levels in most of South Carolina counties are well below these major Southeastern cities.

7. Conclusion and Next Steps

Through the previous discussion, we can conclude that the price indices estimated by using Aten's model in conjunction with the Census mean rent, Census median rent, and 2000 FMR are statistically the same. The Aten (2006) study is currently undergoing a revision to update the index with 2005 values. Upon completion, the South Carolina county level price index can be updated as well. Otherwise, in order to compute the price level of each South Carolina county on annual basis by using the Aten (2006) model, we need to have the annual CPI rent data in each county. Currently we have difficulty in obtaining this data. We will continue to explore data resources including Bureau of Economic Analysis to get the data to generate price index for South Carolina.

References

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Table 1: South Carolina County & State Price Index

County	Price Level by 2000 FMR	Price Level by Census Mean	Price Level by Census Median
Abbeville	0.88	0.87	0.85
Aiken	0.96	0.93	0.91
Allendale	0.88	0.87	0.88
Anderson	0.96	0.92	0.89
Bamberg	0.88	0.8	0.8
Barnwell	0.88	0.86	0.84
Beaufort	0.98	1.09	1.02
Berkeley	0.97	0.96	0.96
Calhoun	0.88	0.86	0.82
Charleston	0.98	1.06	1.04
Cherokee	0.96	0.87	0.87
Chester	0.88	0.88	0.87
Chesterfield	0.88	0.87	0.88
Clarendon	0.88	0.83	0.83
Colleton	0.88	0.84	0.8
Darlington	0.89	0.85	0.85
Dillon	0.88	0.84	0.81
Dorchester	0.97	1	0.99
Edgefield	0.96	0.88	0.89
Fairfield	0.9	0.86	0.85
Florence	0.91	0.91	0.91
Georgetown	0.89	0.94	0.94
Greenville	0.96	1	0.98
Greenwood	0.89	0.92	0.93
Hampton	0.88	0.84	0.84
Horry	0.96	0.99	0.99
Jasper	0.88	0.91	0.91
Kershaw	0.88	0.91	0.89
Lancaster	0.89	0.9	0.89
Laurens	0.88	0.94	0.91
Lee	0.88	0.83	0.83
Lexington	0.98	0.95	0.94
Marion	0.88	0.83	0.83
Marlboro	0.88	0.87	0.84
McCormick	0.89	0.84	0.82
Newberry	0.88	0.83	0.78
Oconee	0.88	0.86	0.83
Orangeburg	0.88	0.87	0.87
Pickens	0.96	0.95	0.96
Richland	0.98	0.99	0.99
Saluda	0.88	0.85	0.83
Spartanburg	0.96	0.91	0.91
Sumter	0.92	0.92	0.9
Union	0.88	0.85	0.83
Williamsburg	0.88	0.83	0.84
York	1.05	0.98	1
S.C.	0.95	0.95	0.94

Table 2: Index Relationship

Index by Median vs. Index by Mean		
R Square	0.923618392	
Adjusted R Square	0.921882447	
	Coefficients	*P-value*
Intercept	0.017707928	0.641919
Index by Mean	0.967732962	3.31E-26

Index by Median vs. Index by FMR		
R Square	0.62477633	
Adjusted R Square	0.61624852	
	Coefficients	*P-value*
Intercept	-0.168527893	0.179515192
Index by FMR	1.15668372	6.43821E-11

Index by Mean vs. Index by FMR		
R Square	0.578081431	
Adjusted R Square	0.568492372	
	Coefficients	*P-value*
Intercept	-0.109965486	0.402605322
Index by FMR	1.104937214	8.81321E-10

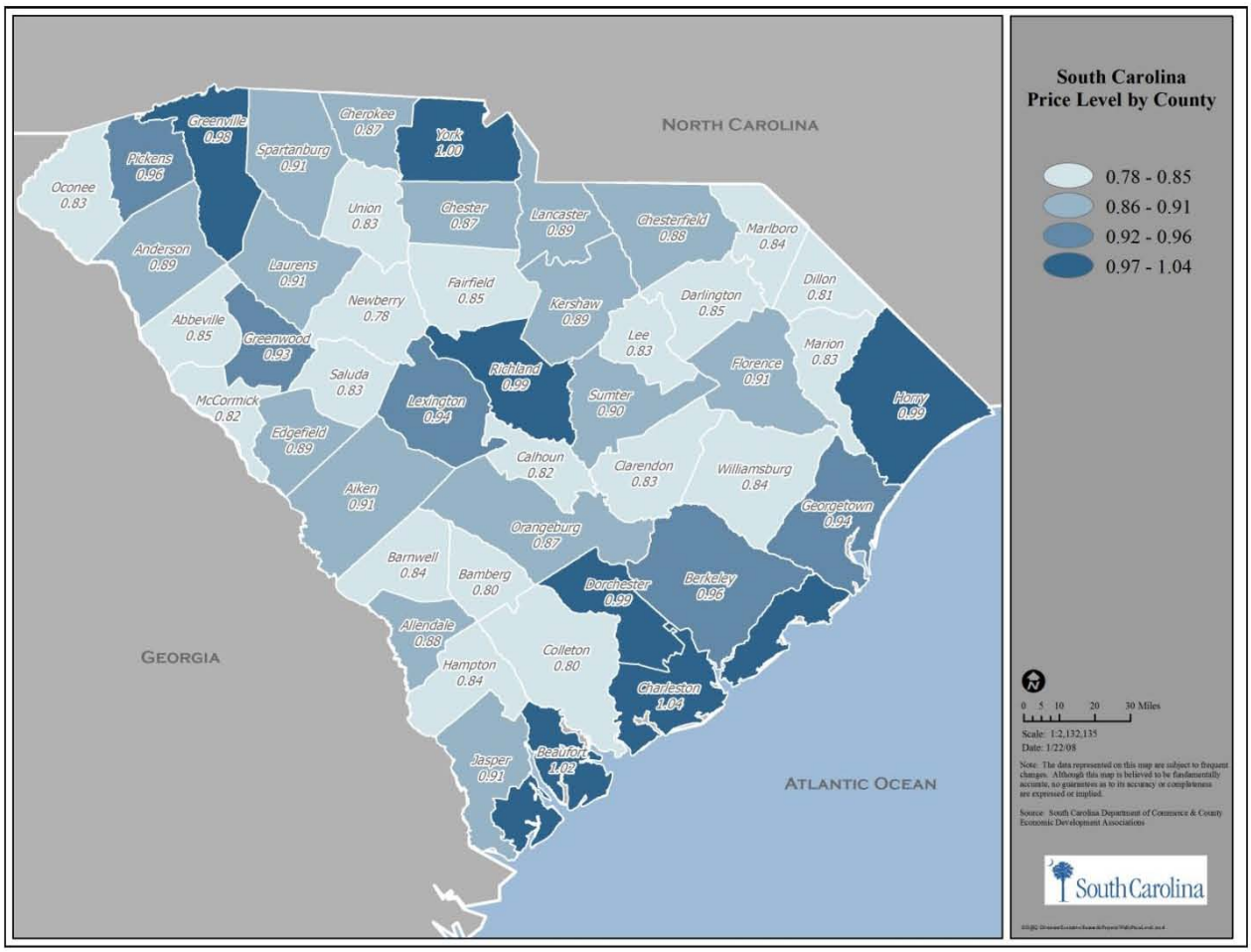
Table 3: Index Relationship: t-test on β

Model	**t Statistics**	**Critical t Statistics**
Index by Median vs. Index by Mean	-0.77	
Index by Median vs. Index by FMR	1.15	2.02
Index by Mean vs. Index by FMR	0.74	

Table 4: Price Level in Major Southeastern Metropolitan Cities

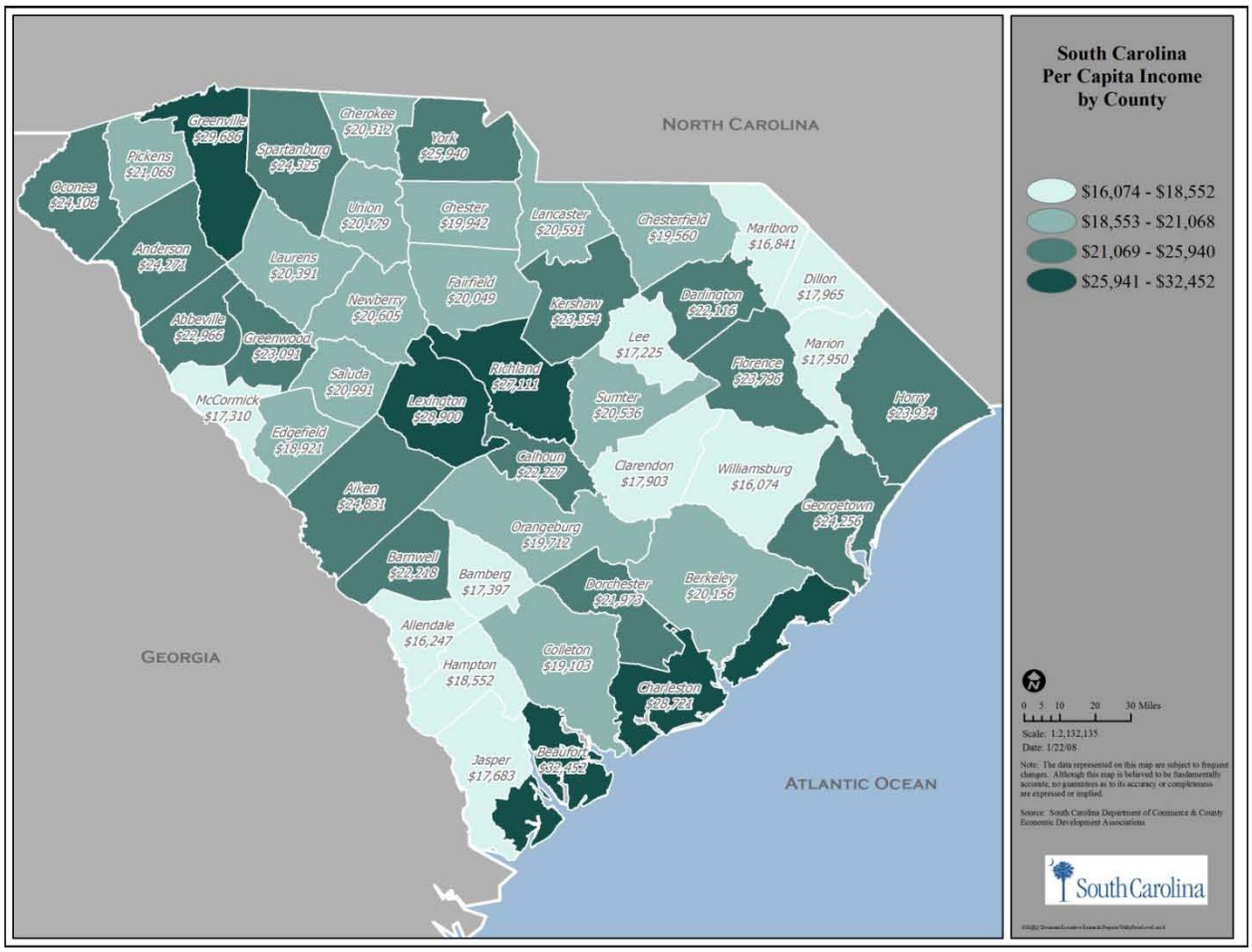
Metropolitan City	Price Level
Asheville, NC	1.03
Charlotte, NC	1.1
Raleigh, NC	1.12
Winston-Salem, NC	1
Knoxville, TN	0.95
Nashville-Davidson, TN	1.04
Memphis, TN	1
Atlanta, GA	1.06
Augusta-Richmond, GA	0.95
Savannah, GA	0.98
Birmingham, AL	0.93
Mobile, AL	0.95
Jackson, MS	0.96
Jacksonville, FL	1.02
Orlando, FL	1.12
Miami, FL	1.21
Richmond, VA	1.02
New York, NY	1.71

Appendix A: South Carolina Price Level by County



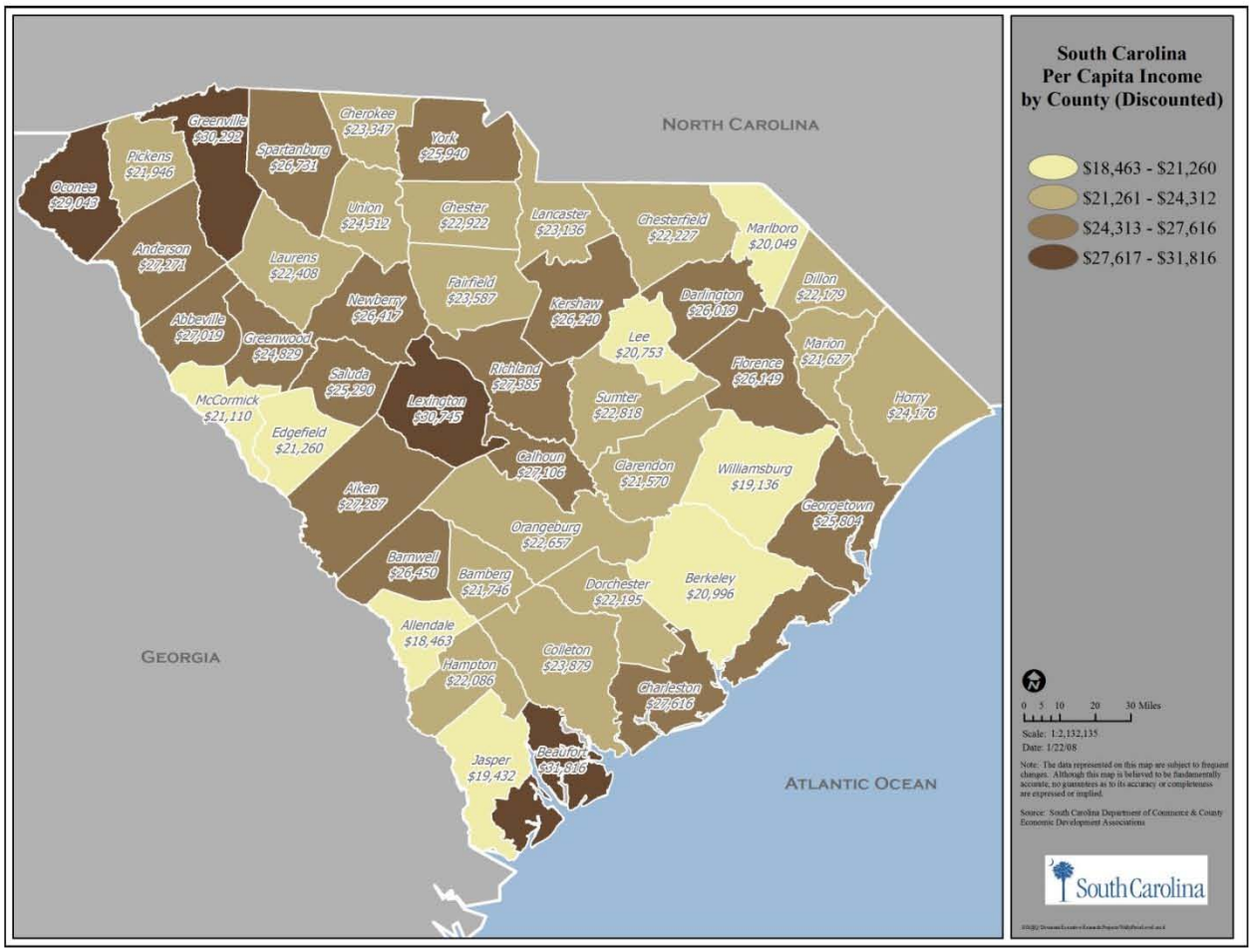
Source: County price levels computed using Aten (2006) methodology with 2000 Census median rent data as inputs.

Appendix B: 2000 South Carolina Per-Capita Income by County



Source: 2000 Census

Appendix C: 2000 South Carolina Per-Capita Income by County (Discounted by Price Level)



Source: 2000 Census per-capita income discounted by author-calculated county price levels (computed using Aten (2006) methodology with 2000 Census median rent data as inputs).